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Forest Insect and Disease Conditions in Alaska - 1992

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FOREST INSECT AND DISEASE CONDITIONS IN ALASKA -- 1992

General Technical Report R10-TP-32

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FOREST INSECT AND DISEASE CONDITIONS IN ALASKA - 1992

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FOREST INSECT AND DISEASE CONDITIONS IN ALASKA - 1992

CONDITIONS IN BRIEF

Forest insect and disease populations and related damage increased throughout Alaskan forests in 1992. This was the fourth consecutive year with warm dry weather in spring and early summer, which allowed insect populations to explode, especially in South-Central and Interior Alaska. Spruce bark beetle activity increased for the fourth consecutive year. New and ongoing infestations of spruce bark beetle, as determined by 1992 aerial surveys, now affect more than 600,000 acres. This is the greatest known acreage affected by spruce bark beetle in Alaska. Increased bark beetle activity occurred in the Copper River area near Chitina; the Clam Gulch-Tustumena Lake areas on the Kenai Peninsula, and portions of the west side of Cook Inlet near the Skwentna River. The Yukon River outbreak decreased significantly in 1992. Spruce bark beetle levels increased in Sitka spruce stands along Turnagain Arm; 585 acres of infested spruce were detected from Ingrahm Creek to Hope. This increase is of concern as this is the first increase recorded in this area.

Hardwood defoliator activity increased for the third consecutive year throughout most of south-central and interior Alaska with willow defoliation accounting for the majority of the increase. Assorted leaf miners, noctuid, and rusty-tussock moth larvae were responsible for the defoliation of more than 150,000 acres of willow. Spruce budworm populations exploded near Fairbanks and Delta Junction and along the Yukon River in interior Alaska where more than 160,000 acres of white spruce were defoliated. Black-headed budworm defoliation in Prince William Sound decreased in 1992. However, black-headed budworm populations increased for the first time along Turnagain Arm in the Portage/Turnagain Pass areas.

In southeast Alaska, three different defoliating insects caused substantial defoliation of western hemlock and Sitka spruce. The black-headed budworm, spruce needle aphid and hemlock sawfly caused notable defoliation at various locations across southeast Alaska. Black-headed budworm defoliated over 87,000 acres of mature western hemlock and Sitka spruce in areas located primarily north of Frederick Sound. Budworm defoliation of this magnitude has not been noted in southeast Alaska since the early 1960's. Spruce needle aphid defoliated approximately 25,000 acres of Sitka spruce and caused significant damage to ornamental spruce in several communities. Hemlock sawflies defoliated approximately 6500 acres of mature western hemlock on Prince of Wales Island and within Misty Fjords National Monument. Spruce budworm caused heavy defoliation of Sitka spruce and western hemlock for the third consecutive year along the Chilkat River near Haines. Spruce beetle activity increased slightly within Glacier Bay National Park and increased substantially on state lands near Haines. Spruce beetle activity in these two areas now encompasses approximately 25,000 acres.

The most significant diseases of Alaskan forests are those that persist chronically on sites from year-to-year: yellow cedar decline, wood decay of live trees, and hemlock dwarf mistletoe. More than 526,000 acres of cedar decline occur in Southeast Alaska in a broad band from western Chichagof Island through the Ketchikan area (Appendix A). Heartrot and buttrot fungi caused significant cull in all tree species in Alaska. Hemlock dwarf mistletoe continued to cause growth loss and mortality in old-growth forests of Southeast Alaska; its impact in young-growth stands appears to depend on the presence of large infected residuals left after harvesting of the previous stands. An outbreak of hemlock canker, caused by the fungus *Xenomeris abietis* and possibly aggravated by dust, killed small hemlocks and the lower branches of large hemlock trees along more than 60 miles of unpaved roads on Prince of Wales Island for the third consecutive year. The disease also developed for the first recorded time along roads near Rowan Bay on Kuiu Island, Corner Bay on Chichagof Island, and Caroll Inlet on Revillagigedo Island. Spruce needle rust was present at relatively high levels throughout Alaska, but most other foliar pathogens occurred at low to moderate levels in 1992. *Rhizosphaera* needle cast, however, was quite visible on Sitka spruce throughout the Girdwood, Twenty-mile, and Portage Valleys south of Anchorage. Porcupines continued to damage spruce and hemlock in valuable young-growth stands in southeast Alaska. Decay, canker, and foliar fungi caused a large, but unmeasured damage to hardwood species in interior Alaska.

Table 1 summarizes insect and disease activity by land ownership.

Table 1. 1992 Forest insect and disease infestation in Alaska by land ownership and pest.[a]

Pest	National Forest	Other Federal	Native	State & Private
	Acres			
Spruce beetle	28,816	225,343	118,794	231,856
Larch Beetle	-----	2,000	-----	----
Engravers	182	----	1,237	811
Spruce budworm	----	----	47,089	133,430
Black-headed budworm	70,431	4,826	5,137	15,879
Hemlock sawfly	6,539	----	----	----
Spruce needle aphid	14,945	778	2,180	7,317
Large aspen tortrix	----	935	2,510	16,076
Birch defoliation	----	----	----	1,713
Cottonwood defoliation	5,060	934	----	311
Willow defoliation	1,090	55,712	39,621	57,256
Yellow-cedar decline[b]	541,349	-----	17,667	10,430
Totals	668,412	290,528	234,235	475,079
GRAND TOTAL	1,668,254 acres			

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[a] Table entries do not include many of the most destructive diseases (e.g., wood decays and dwarf mistletoe) because these losses are not detectable in aerial surveys.

[b] Value of yellow-cedar decline is not restricted to the acreage with a high concentrations of dying trees for this year; it represents stands that generally have long-dead trees, recently-dead trees, dying trees, and some healthy trees. See Appendix for a detailed listing by island and Ranger District.

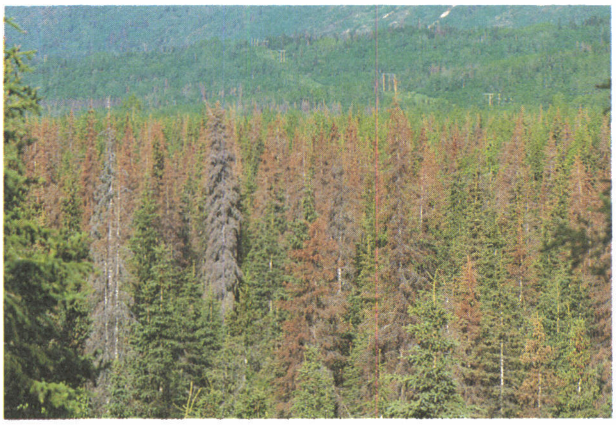

Figure 1. Heavy mortality of Lutz spruce (>50 killed trees/acre) caused by spruce bark beetle on the Kenai Peninsula.

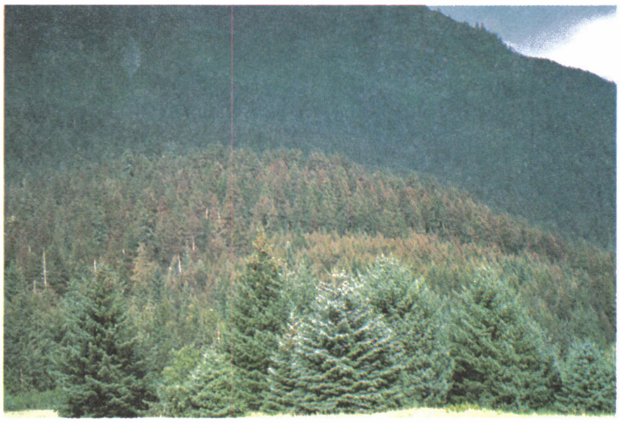

Figure 2. Black-headed budworm defoliation of mature Sitka spruce and western hemlock, Lemon Creek drainage, Juneau, AK.

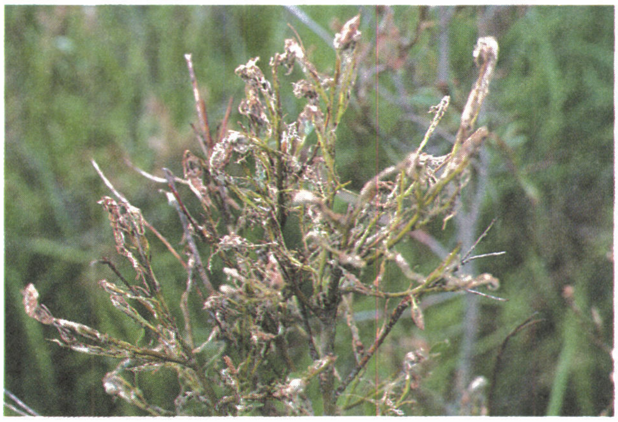

Figure 3. Willow defoliation, Nushagak River, Alaska.

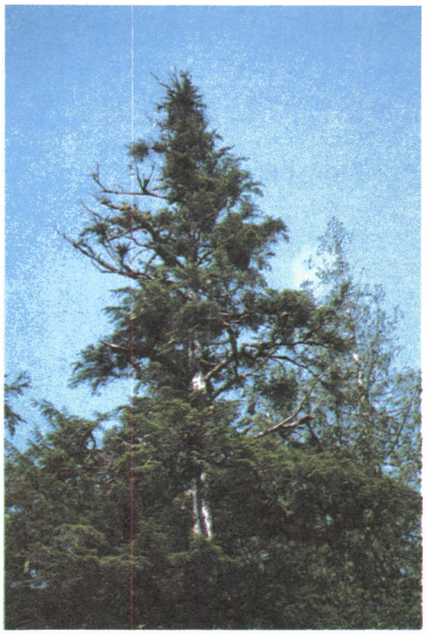

Figure 4. Dwarf mistletoe on western hemlock on Etolin Island in southeast Alaska.

STATUS OF INSECTS

SPRUCE BEETLE

Dendroctonus rufipennis Kirby

Alaska spruce bark beetle populations increased dramatically for the third consecutive year in 1992. Newly detected infestations as well as active on-going infestations now cover more than 600,000 acres of Alaska's spruce forests. This is an increase of more than 200,000 acres over levels infested in 1991. More than 90% of spruce bark beetle activity is occurring in the Lutz and white spruce stands of south-central and interior Alaska. Unusually warm spring and early summer weather conditions throughout south-central and interior Alaska for four consecutive years have helped increase bark beetle populations by decreasing spruce beetle developmental times from two to one year. Likewise, warm dry spring and summer weather conditions may have increased spruce susceptibility to spruce beetle attack by decreasing host defense mechanisms; mainly resin exudation.

White, Lutz, and Sitka spruce mortality continues on 28,658 acres of the Chugach National Forest and is an increase (9,000 ac.) over the acreage infested in 1991. The majority of the spruce beetle activity on the Chugach National Forest is located from the Russian Lakes (5,000 ac.) to and along the Sterling Highway between Broadview Guard Station and Gwin's Lodge near Summit Lake (2,024 ac.). Likewise, spruce bark beetle activity has increased near Hope on the Kenai Peninsula where more than 1,000 acres of maritime Sitka spruce have been infested. Spruce beetle activity has increased for the second year on State and private lands near Moose Pass; 5,527 acres of spruce were infested along the north shore of Upper Trail Lake.

Spruce beetle activity increased dramatically further south on the Kenai Peninsula on Kenai National Wildlife Refuge lands and adjoining State and private lands. Spruce bark beetle activity was detected on more than 300,000 acres from Pt. Possession in the northern Kenai Peninsula to Kachemak Bay to the south. This represents a substantial increase over levels (187,842 acres) detected in 1991. It appears that most forested areas of the Kenai Peninsula are experiencing increased spruce beetle activity especially in the Lutz spruce forests north of Homer. For example, 184,799 acres of infested Lutz spruce were detected this year from Skilak Lake south to Ninilchick, from Cook Inlet east to the Harding Ice Field vs. 101,543 acres detected in 1991 vs. 39,033 acres detected in 1990 in the same areas. With respect to the Kachemak Bay area, there appears to be a slight increase in spruce beetle activity over levels detected in 1991: 12,454 acres vs. 6,820 acres. The majority of this increase has occurred in the Aurora Spit (10,975 ac.) and Halibut Cove (1,245 ac.) areas.

Spruce beetle activity on the west side of Cook Inlet decreased by half in 1992; approximately 17,000 acres of infested spruce were aerially detected. Areas of significant spruce beetle activity include: Beluga Lake to the Skwentna River (2,958 ac.); the

Skwentna River, from Shell Lake to its headwaters (10,976 ac.); and along the McArthur River (1,168 ac.)

Spruce beetle levels increased in the Sitka spruce stands along Turnagain Arm; 585 acres of infested spruce were detected from Ingrahm Creek to Hope. Spruce beetle populations showed a slight increase in the Indian Creek Valley where 35 acres of scattered tree mortality were observed. This increase in beetle activity in spruce stands bordering Turnagain Arm is of concern as this is the first increase recorded in this area. The Turnagain Arm area is extremely important for its aesthetic values. The Seward Highway National Scenic By-Way passes through this area. Spruce beetle activity will be carefully monitored in subsequent years.

Bark beetle activity in the Anchorage Bowl area, however, did not increase over 1991 levels of approximately 2,000 acres. The largest area of spruce beetle activity (1,335 acres) was once again in the Potter/Rabbit Creek areas of the Hillside. Small, isolated pockets of spruce beetle activity were also detected on Fire Island (415 ac.) and throughout the lower Hillside area.

Further north, spruce beetle activity was apparent from Ship Creek to Eagle River along the Chugach Mountains (1,070 ac.); 2,335 acres throughout the Ship Creek drainage; and 780 acres of scattered spruce beetle caused tree mortality in the Eagle River valley. Likewise, scattered spruce beetle activity was noted along the Richardson Highway from Palmer to Kings Mountain (545 ac.) and from Sutton to Sheep Mountain Lodge (5,994 ac.). Spruce bark beetle activity continues further west near Lake Clark and Lake Iliamna. 11,241 ac. of scattered infested spruce were detected along the entire east end of Lake Iliamna. Another 2,335 acres of scattered spruce beetle infested trees were detected on the south-west side of Lake Clark Pass.

Spruce bark beetle activity in the Tiekel River area and north and east to Gulkana and McCarthy was high for the second consecutive year; more than 77,426 acres of infested spruce were aerially detected. The areas of heaviest and most intensive spruce beetle activity include: 59,706 acres from Copper Center to the Tiekel River, west of the Copper River; 10,431 acres along the east side of the Copper River from Copper Center to Chitina and 5,343 acres scattered around Gulkana/Glennallen areas. This current spruce beetle activity has the potential of becoming one of Alaska's largest infestations.

Spruce beetle activity along the Yukon River significantly decreased in 1992. It appears that the outbreak, after more than five years of activity, is declining. 52,314 acres of scattered infested spruce were detected in 1992 vs. 80,000 acres in 1991. Most are areas of continuing, not new, infestations and include: 30,362 acres along the Yukon River from Fox Pt. Island to Quail Island and 17,126 acres along the Yukon River from Quail Island to Galena. Bark beetle activity increased, however, along the South Fork of the Nulatto River in 1992: 11,365 acres vs 4,359 acres in 1991.

Spruce beetle activity was detected along the Kuskokwim River on more than 15,000 acres this year; almost double the amount detected in 1991. Areas of heaviest infestations include: 7,000 acres 15 miles east of Aniak; 2,500 acres scattered along the Kuskokwim River 18 miles NE of Stony River Village; and an additional 4,500 acres scattered throughout the white spruce stands bordering the Kuskokwim River downstream from McGrath. Spruce beetle activity also increased along the Stony River (2,000 ac.), a tributary of the Kuskokwim River.

In Southeast Alaska, two major spruce beetle outbreaks continued to expand. The spruce beetle outbreak within Glacier Bay National Park increased slightly, following several years of declining activity. Approximately 29,000 acres of mature Sitka spruce have been affected since spruce beetle was first detected there in the late 1970's. Current beetle activity was noted on over 11,000 acres located primarily within the Beardsley Islands and on the mainland between the park's visitor center and Point Gustavus. Barring a large catastrophic windthrow event, spruce beetle activity within Glacier Bay should decline over the next few years. In the 12 years since spruce beetle activity was first detected at Glacier Bay, many of the trees killed in the initial attacks have blown over or broken off. In areas of heaviest initial mortality, where stands are most open, regeneration (primarily hemlock) is abundant.

The spruce beetle outbreak on state lands near Haines continued to expand rapidly. Spruce beetle activity totalling 4200 acres was first noted in the Klehini, Chilkat, and Kelsall River drainages in 1990. The current area of infestation encompasses over 14,000 acres.

During the winter of 1990-91, strong winds blew down large patches of timber near the confluence of the Wright and Taku Rivers (state, private and National Forest land). Investigations during 1991 and 1992 indicated a significant spruce beetle buildup in windthrown trees. Infestation of adjacent stands is likely in 1993.

In 1992, spruce beetle infestations throughout Alaska by ownership are as follows; National Forest land -28,816 acres; State and Private - 231,856 acres, Native land - 118,794 acres and other Federal lands (e.g. Kenai National Wildlife Refuge, National Parks, etc.) -225,343 acres.

ENGRAVERS

Ips perturbatus Eichh.

Engraver activity decreased in 1992 with 1,892 acres of infested white spruce aerially detected this year versus more than 5,000 acres detected last year. The majority of the infested areas were scattered along the Yukon, Chandalar, and Porcupine Rivers in interior Alaska. The expected increase in *Ips* caused tree mortality in the Fairbanks area did not occur.

EASTERN LARCH BEETLE

Dendroctonus simplex (LeC.)

The 3,000 acres of eastern larch beetle activity detected last year near Delta Junction was not apparent this year. However, approximately 2,000 acres of larch beetle activity was observed in northwest Alaska near Norutuk Lake. Larch beetle activity will continue to be scattered and low as most of the susceptible host material was killed in the large infestations of the early 1970's.

SPRUCE BUDWORM

Choristoneura sp.

Spruce budworm populations increased dramatically in interior Alaska's white spruce stands for the third consecutive year. 1992 aerial surveys detected more than 160,000 acres of defoliated spruce; more than eight times the amount noted in 1991. Largest areas of defoliation included: 56,203 acres scattered along the middle portion of the Yukon River from Galena upstream to the Kokrine Hills; 29,425 acres along the Tanana River near Manley Hot Springs; and 28,646 acres 26 miles NNW of Delta Junction. The largest expanse of budworm defoliation continues to occur along the Nenana Ridge and throughout the Goldstream Valley near Fairbanks. Impact studies conducted by research scientists at the Institute of Northern Forestry have shown significant decreases in diameter growth of defoliated spruce. There is concern that these budworm defoliated trees are stressed and as such are increasingly more susceptible to *Ips* attack and subsequent tree mortality.

In Southeast Alaska, spruce budworm caused over 11,500 acres of heavy defoliation on western hemlock and Sitka spruce along the Chilkat River north of Klukwan. 1992 marked the third consecutive year of budworm activity in this vicinity. Defoliated areas are immediately adjacent to areas of ongoing spruce beetle activity. Mature spruce weaken by repeated defoliation may be subject to future spruce beetle attack. Defoliation along the Chilkat River (above Mosquito Lake) is again likely in 1993.

WESTERN BLACK-HEADED BUDWORM

Acleris gloverana Walsingham

Black-headed budworm defoliation of western hemlock and Sitka spruce in Prince William Sound declined in 1992 for the second consecutive year. Aerial detection surveys noted 4,990 acres of infested hemlock and spruce vs. 7,500 acres in 1991 and 40,000 acres in 1990. Areas most seriously infested include: 256 acres on Knight Island; 200 acres along Bainbridge Island; 467 acres ESE of Cordova; 467 acres on Hawkins Island; 700 acres on Hinchinbrook Island; and 623 acres in the Port Gravina area.

Black-headed budworm populations increased for the first time along Turnagain Arm in the Portage Valley/Turnagain Pass areas where more than 3,600 acres of Sitka spruce, western, and mountain hemlock were defoliated. The most extensive areas of defoliation occurred along the Seward Highway from Ingrahm Creek to Turnagain Pass. Budworm populations are expected to remain high next year with minimal damage resulting from larval defoliation.

The black-headed budworm was the most significant forest defoliator in southeast Alaska in 1992. Approximately 87,666 acres of mature western hemlock and Sitka spruce were defoliated. Budworm activity of this magnitude has not been noted in southeast Alaska since the early 1960's. Population explosions were evident at numerous locations throughout southeast Alaska, but were concentrated primarily north of Frederick Sound.

The heaviest black-headed budworm defoliation was noted on Admiralty Island and in the Juneau vicinity. Areas of heavy defoliation on Admiralty Island included: Mole Harbor (1556 acres), Gambier Bay (10,281 acres), White Water Bay (2650 acres), Hood Bay (8417 acres), and Kootznahoo Inlet (3425 acres). Areas of heavy defoliation in the Juneau vicinity included Lemon Creek, Mendenhall Peninsula, Sunny Point, southeast Mendenhall Valley, Auke Bay and Lena Point. Defoliation of ornamental hemlock and spruce, common around the Auke Bay and Mendenhall Peninsula areas, caused some concern among property owners. Light defoliation was also noted on North Douglas Island. Budworm defoliation in the Juneau vicinity totalled 10,431 acres.

Areas of light to moderate defoliation (north of Frederick Sound) included: approximately 2600 acres along the Katzehin River (mainland, east of Chilkoot Inlet), approximately 5000 acres in the Seymour Canal area (Admiralty Island), approximately 1000 acres along the Herbert and Eagle Rivers north of Juneau, approximately 1000 acres on Moser and Baranof Islands (Hoonah Sound and Peril Strait), and approximately 3200 acres near Whitestone Harbor and 1700 acres north of Hoonah (Chichagof Island).

All budworm defoliation noted south of Frederick Sound was light to moderate in intensity. Concentrations of defoliation included: approximately 300 acres on Big Castle Island (Duncan Canal), approximately 600 acres along Southeast Cove (Wrangell Island), approximately 2600 acres on Etolin Island (Mosman Inlet and Steamer Bay), approximately 150 acres on Bushy Island, approximately 450 acres on Shrubby Island, almost 1600 acres adjacent to Anan Bay, approximately 600 acres near Edna Bay (Kosciusko Island) and approximately 2800 acres north of Naha Bay (Revillagigedo Island).

Numbers of black-headed budworm larvae sampled from defoliator plots varied greatly north and south of Frederick Sound. Numbers of larvae (and acres of defoliation) were consistently higher north of Frederick Sound. North of Frederick Sound, the largest numbers of larvae were collected at Taku Harbor (mainland, southeast of Juneau) and the North Arm of Hood Bay (Admiralty Island, south of Angoon). South of Frederick Sound, the largest numbers of larvae were collected at High Island (between Kuiu and Kupreanof Islands) and Duncan Canal (Kupreanof Island).

Without unforeseen impact on overwintering eggs or young larvae next spring, black-headed budworm populations (and subsequent defoliation) will increase in 1993. Quantity and severity of defoliation will again be greatest within forests north of Frederick Sound.

HEMLOCK SAWFLY

Neodiprion tsugae Middleton

In southeast Alaska, defoliation of mature western hemlock by hemlock sawfly increased significantly from 1991 to 1992. In 1992, sawflies defoliated approximately 6539 acres (900 acres in 1991) of mature western hemlock on the Tongass National Forest south of Sumner Strait. Defoliation was evident near the head of the North Arm of Moira Sound and adjacent to Sunny Cove (Cholmondeley Sound) on Prince of Wales Island, on the north side of Neets Bay (Revillagigedo Is.), and on Smeaton Island and near Winstanley Lakes within Misty Fjords National Monument.

The highest sawfly larvae counts of the 1992 survey were collected at High Island (between Kupreanof and Kuiu Islands, Petersburg Ranger District) and at Princess Bay (Revillagigedo Is., Misty Fjords National Monument). Sawfly activity is expected to continue to increase on the southern Tongass National Forest in 1993.

SPRUCE NEEDLE APHID

Elatobium abietinum Walker

Following the mild winter of 1991-92, large spruce needle aphid populations caused defoliation of Sitka spruce throughout southeast Alaska. Defoliation was noted on a total of 25,220 acres. As with past aphid activity, impact was most severe in urban settings and along marine shorelines.

Aphid defoliation of mature Sitka spruce was evident along many miles of shoreline from Excursion Inlet (mainland), south to Prince of Wales Island. Aphid activity was noted at several locations on Admiralty, Baranof, Chichagof, Douglas, Krestof, Kuiu, Kupreanof, Mitkof, Partofshikof, Prince of Wales, and Wrangell Islands.

Aphid-caused defoliation of ornamental spruce occurred in Sitka, Ketchikan, Wrangell, Petersburg, Juneau, Craig, Klawock, Thorne Bay, and Elfin Cove. Needle aphid damage appeared to be most severe in and around Sitka. Tree mortality is likely among the most heavily defoliated individuals.

If southeast Alaska experiences a mild winter in 1992-93, spruce needle aphid activity can be expected to continue in 1993. Repeated years of aphid activity could cause significant damage and some mortality of ornamental spruce in urban settings.

SPRUCE BUD MOTH
Zeiraphera **sp.**

Populations of the spruce bud moth rebounded southeast of Yakutat in 1992. Defoliation was visible on approximately 5138 acres of Sitka spruce between Dry Bay and the Akwe River. Though 8600 acres of defoliation were noted northwest of this area in 1990, defoliation was not apparent in 1991.

LARGE ASPEN TORTRIX
Choristoneura conflictana Wlkr.

Tortrix populations increased slightly in 1992. 19,521 acres of defoliated aspen were detected this year vs. 4,120 acres in 1991. Areas of concentrated tortrix activity include: 5,760 acres along the Parks Highway near Cantwell; 3,036 acres along the Richardson Highway near Sutton; 4,126 acres of defoliated aspen from Glenallen to Copper Center along the Old Edgerton Highway. Some growth loss and top-kill can be expected from heavily defoliated hosts. Tree mortality, however, is rare. Tortrix populations normally increase rapidly for two to three years with defoliation covering hundreds of thousands of acres followed by an equally rapid decline.

WILLOW DEFOLIATION

The amount of willow defoliation increased slightly throughout south-central and interior Alaska in 1992 as a result of three consecutive warm, dry springs and early summers. 1992 aerial surveys detected more than 150,000 acres of defoliated willow; 20,000 acres more than last year. The most heavily defoliated areas continue to be the riparian zones along the Yukon, Kuskokwim, Mulchatna, and Nushagak Rivers as well as in the Lake Clark/Iliamna areas; Seward and Kenai Peninsulas. There is no single causal agent involved in this expansive defoliation but rather a varied group of defoliators. For example, many thousands of acres of willow near Fairbanks and along the Yukon River were defoliated by a willow blotch miner (Gracillariidae: *Micrurapteryx salicifoliella*) whereas Rusty Tussock Moth larvae (Lymantriidae: *Orgyia antigua*) were responsible for much of the willow defoliation along the Kuskokwim River and throughout the Seward Peninsula. Leaf beetles (Chrysomelidae: *Chrysomela* spp.) were the most commonly encountered willow defoliators on the Kenai Peninsula.

COTTONWOOD DEFOLIATION
Chrysomela **sp. and** ***Lyonetia*** **sp.**

Approximately 13,736 acres of defoliated cottonwood were detected in 1991 with approximately 50% occurring in Prince William Sound. 1992 defoliation levels, however, decreased as only 234 acres of cottonwood defoliation were observed near Sheridon Glacier in Prince William Sound.

Cottonwood defoliation by leaf beetles totalled approximately 6,000 acres in southeast Alaska in 1992. Defoliation was noted along the Dangerous, Katzehin, Stikine, Skagway and Taiya Rivers. Leaf beetle defoliation of willow was noted during field activities at several locations, but was not detectable during the aerial survey.

BIRCH DEFOLIATION

A few hundred acres of birch were heavily defoliated on Ft. Richardson Military land along the southside of the Glenn Highway near Ship Creek in 1991. The causal agents were identified as *Sunira verberata* (Smith) and *Parastichtis discivaria* (Wlkr). Both noctuids are transcontinental in distribution and are not noted as important defoliators. Populations did not increase this year as expected; no visible defoliation was noted.

In 1992, leaf miners caused noticeable birch defoliation along the Haines highway for the fourth consecutive year.

STRIPED ALDER SAWFLY
Hemichroa crocea (Fourcroy)

In Southeast Alaska, defoliation of alder was noted along the Stikine River for the second consecutive year. Defoliation in and around Guerin Slough area totalled 623 acres.

In early July around Juneau, alder sawfly larvae were found to be infected by the fungus, *Entomophthora* sp. The fungus was effective in reducing numbers of larvae, however, most of the larvae did not die before causing significant alder defoliation.

GALL MIDGE

A newly detected gall midge was noted on yellow-cedar saplings at Anita Bay (Etolin Island). The midge causes galls on yellow-cedar foliage and its potential impact is not yet known. The midge has been tentatively identified as *Chamaediplosis* sp.

GYPSY MOTH
Lymantria dispar **(L.)**

The European Gypsy Moth was accidently introduced into Massachusetts from Europe in 1869 and the rest is history! Since then, the gypsy moth has been responsible for considerable damage to the hardwood forests of the eastern United States. Millions of dollars are spent annually attempting to reduce the amount of damage and restrict the distribution of this important forest pest. However, the european gypsy moth arrived in the western U.S. in the early 1980's.

Historically, there has been little european gypsy moth activity in Alaska. In 1985, several larvae were detected by moving company employees on lawn furniture which had been shipped to Juneau from the East Coast. Every summer since 1986, USDA Forest Health Management in cooperation with the Cooperative Extension Service and the USDA Animal and Plant Health Inspection Service, has placed pheromone monitoring traps throughout Alaska, especially in locations frequented by out-of-state vehicles, including campgrounds and port areas. To date, only two male european gypsy moths have been trapped: one in a campground near Anchorage in 1987 and the other in a campground near Fairbanks in 1992. Due to the recent detection of the Asian Gypsy Moth, a much more damaging race of the european gypsy moth, in the Pacific Northwest, the Alaskan pheromone trapping program was expanded in 1992; more than 300 traps were placed throughout Alaska from Petersburg to Nome, including Dutch Harbor. No asian gypsy moths were encountered. If the asian gypsy moth becomes established in the western U.S., including Alaska, the potential impacts to forests and riparian areas could be tremendous. The extensive trapping program will be carried out again next year.

STATUS OF DISEASES

HEMLOCK DWARF MISTLETOE

Arceuthobium tsugense (Rosendhal) G.N. Jones

Dwarf mistletoe is abundant in unmanaged, old-growth stands throughout southeast Alaska as far north as Haines. Within the range of western hemlock, dwarf mistletoe is absent from Cross Sound to the northwest along the Gulf of Alaska; thus, managers need not be concerned about the disease in these areas.

Old-growth hemlock stands in southeast Alaska vary in their level of infestation from stands in which almost every western hemlock tree is infected to other stands in which the parasite is absent. Sitka spruce and mountain hemlock are only rarely infected. Most old-growth stands below about 500 feet elevation have some level of infestation. The disease is uncommon at higher elevations.

Heavily infected western hemlock trees have branch proliferations (witches-brooms), bole deformities, reduced radial growth, or may die -- all potential problems in stands managed for wood production. On the other hand, witches-brooms, wood decay associated with bole infections, and scattered tree mortality can result in greater diversity of forest structure and increased animal habitat. For example, witches-brooms may provide hiding or nesting habitat for birds or small mammals. Heavily infested hemlock stands can begin to decline and collapse to the extent that diversity and animal habitat are diminished, however. When mixed-species stands are heavily infected, growth of resistant species such as Sitka spruce and the cedars may be enhanced.

Spread of the parasite into young-growth stands is typically by: 1) infected non-merchantable hemlock trees (residuals) which are sometimes left standing in cut-over areas, 2) infected old-growth hemlocks on the perimeters of cut-over areas, and 3) infected advanced reproduction. Residuals may play the most important role in the initial spread to young stands. Managers who use new techniques of forest management (e.g., Ecological Management, New Perspectives) where large residuals are left standing in clearcuts, on the edges of small harvest units, or in partial harvests should recognize the probable increased impact of dwarf mistletoe in hemlock overstory trees and in regeneration.

A demonstration area near Thorne Bay on Prince of Wales Island, Alaska was developed to provide information on the recognition, biology, impact, and recommended silvicultural techniques for managing hemlock dwarf mistletoe in young-growth stands. Killing infected residual hemlocks (by girdling or felling) and discrimination against advanced reproduction during precommercial thinning can help reduce initial spread to young stands. Care in laying out cutting boundaries to avoid infected old-growth hemlock on clearcut perimeters is also suggested. Recent extensive surveys in young-growth stands up to rotation age in southeast Alaska indicate that the disease occurs at low frequency and low impact as long as large infected residual trees are not present. Current studies are examining the incidence and impact of hemlock dwarf mistletoe in mixed-storied stands.

HEMLOCK CANKER
Xenomeris abietis Barr.

Hemlock canker continued to develop at outbreak levels for the third consecutive year on Prince of Wales Island in 1992. Small hemlocks and the lower crowns of large hemlock trees were killed along more than 60 miles of road. The disease had been inconspicuous since 1985, the year of its last outbreak. In the 1985 outbreak, the disease was confined to old-growth stands along about 30 miles of roads on Prince of Wales Island. This year, the disease had a similar, although larger distribution and also extended further from roads than in previous outbreaks. In the current outbreak the disease was present in both old-growth and young-growth stands. As it killed more hemlock in managed young-growth stands, the disease became more of a management problem.

In 1992, new outbreaks were reported and investigated along unpaved roads near Rowan Bay (Kuiu Island) and Corner Bay (Chichagof Island). The disease has also been reported but not examined along a small section of road near Carroll Inlet (Revillagigedo Island).

The causal agent is the fungus *Xenomeris abietis*, but it appears to be unable to damage trees far from roads. Apparently, road dust is necessary for the fungus to invade hemlock tissues successfully. The previous outbreak of the disease began before 1985 and before some roads were paved on Prince of Wales Island. None of the hemlock canker disease was found this year along paved roads, even though the disease was conspicuous in these locations during the previous outbreak (before paving). Thus, road dust may contribute to development of the disease.

SPRUCE NEEDLE BLIGHT
Lirula macrospora (Hartig) Darker
Rhizosphaera kalkhoffii Bubák
Lophodermium picea (Fuckel) Höhn.

Spruce needle blight, caused by the fungus *L. macrospora*, is the most important needle disease of Sitka spruce in coastal Alaska. The disease occurred at low to moderate infection levels in 1992. It was common on young Sitka spruce and the lower crowns of larger trees throughout coastal Alaska. The disease was especially visible in cutover areas and in urban areas. It was found killing needles along with the more destructive spruce needle aphid this year in southeast Alaska. The life cycle of the fungus has recently been elucidated. The timing of sporulation coincides with bud break in the spring and ceases at about the time of full shoot elongation. Using this information, a study recently demonstrated that fungicides applied soon after spruce bud break successfully controls the disease.

Spruce needle blight caused by *Rhizosphaera* was visible on Sitka spruce throughout the Girdwood, Twenty-mile, and Portage Valleys south of Anchorage. This fungus causes premature death, and casting of needles but damage in natural forests is negligible. The fungal disease can cause significant defoliation of spruce in nurseries, plantations, and landscapes outside the native range of the trees.

The fungus *Lophodermium picea* was found killing the needles of ornamental white spruce in the Anchorage area in 1992.

SIROCOCCUS SHOOT BLIGHT
Sirococcus strobilinus Pruess.

The shoots of young-growth western hemlock were killed in moderate levels by the blight fungus *Sirococcus* in southeast Alaska. Sitka spruce and mountain hemlock are sometimes also attacked. Thinning may be of some assistance in reducing damage by the fungus as thinned stands have fewer infections than in unthinned stands.

SHOOT BLIGHT OF YELLOW-CEDAR
Apostrasseria sp.

Regenerating yellow-cedar (*Chamaecyparis nootkatensis*) suffered substantial infection and shoot blight by the fungus *Apostrasseria* sp. in southeast Alaska in 1992. The disease does not affect mature cedar trees, however. The incidence of shoot blight has not changed appreciably over the past several years. Attack by the fungus causes terminal and lateral shoots to be killed back 5 inches or so on seedlings and saplings during winter or early spring. Entire seedlings up to 18 inches tall are sometimes killed. The newly discovered fungus that causes the disease, *Apostrasseria* sp., is closely related to other fungi that cause disease to plants under snow. The fungus *Herpotrichia juniperi* is often found as a secondary invader on seedlings after they die. A recent study at Anita Bay on Etolin Island indicates that yellow-cedar seedlings planted near naturally regenerating yellow-cedar are more likely to become infected with *Apostrasseria*, but the disease is present and building in seedlings planted away from inoculum sources. An inoculation study is planned in 1993 to confirm the pathogenicity of *Apostrasseria* sp.

SPRUCE NEEDLE RUST
Chrysomyxa ledicola Lagerh.

The incidence of spruce needle rust returned to low and moderate levels in 1992 after several years of abundance. The outbreaks on white spruce around Dillingham have apparently subsided as only 390 acres were detected this year; those on Sitka spruce around Juneau returned to average levels. The spores that infect spruce needles are produced on the alternate host, Labrador-tea (*Ledum* spp.), a plant that is common in boggy, poorly drained areas; thus the disease on spruce is most pronounced in these boggy (muskeg) areas. Although the disease can give spruce trees the appearance of being nearly dead, trees rarely, if ever, die from this disease even in years of intense infection.

SPRUCE BROOM RUST
Chrysomyxa arctostaphyli Diet.

Perennial infections result in dense clusters of branches (witches brooms) on white, Lutz, Sitka, and black spruce when infected by this rust fungus. The incidence of spruce broom rust changes little from year to year. It is common wherever spruce grows near the alternate host, bearberry or kinnikinnik (*Arctostaphylus uva-ursi*) in Alaska. The disease is common in interior and south-central Alaska, where scattered individual trees are infected, but only occurs in localized areas of Southeast Alaska where the alternate host is common (e.g., Halleck Harbor area of Kuiu Island and Glacier Bay). The disease may cause slow growth on spruce, although this has not been determined by research. The dense clusters of branches and needles (brooms) are known to provide nesting and hiding habitat for many birds and perhaps for small mammals.

HEMLOCK NEEDLE RUST
Pucciniastrum vaccinii (Rab.) Joerst.

This year, hemlock needle rust once again occurred at low, endemic levels on needles of western hemlock. The disease has not been found at outbreak levels since the late 1970's. The blueberry alternate hosts for this rust fungus (*Vaccinium alaskensis* and *V. ovalafolium*) are very common understory plants in hemlock-spruce forests. With the great abundance of both hemlock and blueberry hosts, reasons for the low incidence of this disease are not known.

WESTERN GALL RUST
Endocronartium harknessii (J.P. Moore) Hirat.

Gall rust was common throughout the distribution of pine in Alaska. Infection by the rust fungus *E. harknessii* causes spherical galls on branches and main boles of shore pine. Typically, infected pine tissues are swollen but are not killed by the rust fungus. Another fungus, *Nectria macrospora*, colonized and killed many of the pine branches with these galls this year. In cases where galls were located on the main bole, the combination of the rust fungus and *N. macrospora* commonly caused top-kill.

FOLIAGE DISEASES OF CEDARS
Gymnosporangium nootkatense Arth.
Didymascella thujina (Durand) Maire

Two fungi that infect the foliage of cedar, *Gymnosporangium* on yellow-cedar and *Didymascella* on western redcedar, occurred at endemic levels this year. *Didymascella* was the more damaging of the two and was common wherever its host was found. Infection by neither fungus resulted in severely defoliated nor death of cedar trees.

YELLOW-CEDAR DECLINE

Decline and mortality of yellow-cedar persists as the most spectacular and important forest diseases in southeast Alaska. About 570,000 acres of decline have been mapped during aerial detection surveys. Concentrated mortality occurs in a wide band from western Chichagof and Baranof Islands to the Ketchikan Area. Ground surveys indicate that 65% of the basal area of yellow-cedar is dead on this acreage. Other tree species are relatively unaffected, although they show increased growth on some sites due to less competition from cedars and slowed growth and mortality elsewhere because of site deterioration (poor drainage). Succession to western hemlock and mountain hemlock appears to be occurring in some stands suffering from decline.

All research suggests that no contagious organism is the primary cause for this intensive and extensive mortality. Some abiotic (non-living) site factor, probably associated with the poorly-drained anaerobic soils where decline occurs, appears to be responsible for initiating and continuing cedar decline. Two hypotheses have been proposed to explain the primary cause of cedar decline -- death could result from (1) toxins produced by anaerobic decomposition in the wet soils or (2) freezing damage to the shallow fine roots in wet soils associated with climatic warming and reduced snowpacks in the last century.

A detailed list of acreage affected by Alaska-yellow cedar decline has been determined from a composite map developed by mapping dead and dying cedar during annual aerial detection surveys conducted over the previous 23 years (Appendix A). Recent research suggests that the total acreage of cedar decline has been increasing very slowly; the slow increase in area of cedar decline is a result of the expansion of existing decline-affected areas (less than 3 feet per year) of decline to adjacent stands. Contained within most declining stands are trees that died up to 100 years ago (snags still standing), more recently killed cedars, dying cedars (with yellow, red, or thinning crowns), healthy cedars, and other tree species.

HEMLOCK FLUTING

Deeply incised grooves and ridges extending vertically along boles of western hemlock characterize hemlock fluting. The problem is common on western hemlock throughout southeast Alaska. This condition reduces the value of hemlock logs because they yield less sawlog volume and bark is contained in some of the wood. The cause of fluting is not completely known, but associated factors include increased wind-firmness of fluted trees, common occurrence on sites with shallow soils, triggering of fluting by growth release, and fluting on boles corresponding with patterns of translocation. Researchers have recently documented the development of fluting in young hemlock stands.

WOOD DECAYS

Conifers. Decay fungi (including heart rot, sap rot, and butt rot fungi) cause substantial loss of wood volume in Alaskan forests. A comprehensive list of wood decay fungi found in Alaska would be quite extensive. Appendix B lists the more common species, and indicates, for each species, its known conifer hosts, type of decay, and mode of attack.

Decay problems are substantial in southeast Alaska where long-lived tree species predominate in old-growth forests, and the slow-growing decay fungi have ample time to cause significant losses. Decay fungi play an important role in the structure and function of coastal old-growth forests where fire and other forms of catastrophic disturbance are uncommon. By predisposing large old trees to bole breakage, these fungi serve as important disturbing factors that cause small scale canopy gaps. Heartrot fungi enhance wildlife habitat -- indirectly by increasing forest diversity through gap formation or more directly by creating hollows in logs or live trees for species such as cavity nesting birds.

The importance of decay fungi in managed young-growth conifer stands is less certain. Wounds on live trees caused by logging activities allow decay fungi to cause appreciable losses. Studies in progress are investigating how frequently fungi enter wounds of different sizes and the rate of subsequent decay in these wounded trees.

In southeast Alaska, the following fungi are the most important causes of wood decay in live trees:

Sitka spruce
  Fomitopsis pinicola
  Phellinus pini
  Armillaria sp.
  Phaeolus schweinitzii
  Laetiporus sulphureus

Western hemlock
  Fomitopsis pinicola
  Armillaria sp.
  Heterobasidion annosum
  Laetiporus sulphureus
  Phaeolus schweinitzii
  Phellinus hartigii
  Phellinus pini

Western redcedar
  Poria albipellucida
  Phellinus weirii

With the exception of *Armillaria* sp., all decay fungi important on Sitka spruce are also important in decay of white spruce in south-central and interior Alaska (and on Lutz spruce on the Kenai Peninsula). In addition, significant volume loss occurs in white and Lutz spruce from butt rot caused by *Coniophora puteana* and *Pholiota alnicola*.

Saprot fungi typically decay dead branches and large woody debris and therefore play an essential role in recycling wood in unmanaged forests. However, saprot decay also routinely becomes established in spruce trees attacked by spruce bark beetles. Large volumes of potentially recoverable timber volume are currently being lost annually on the Kenai Peninsula, where salvage logging has not kept pace with tree mortality from the continuing spruce beetle outbreak. Significant volume loss from saprot appears to begin about 4-5 years following tree death. Several species of saprot fungi (Appendix B) are associated with spruce beetle-caused mortality, but *Fomitopsis pinicola* occurs most commonly.

Hardwoods. Heart rots are the most important cause of volume loss in Alaskan hardwood species. Incidence of heartrot in hardwood species of interior and south-central Alaska is generally high by the time a stand has reached maturity (about 50 years old). Substantial volume loss can be expected in stands 80 years old or older. Detailed data on volume losses by stand age class and forest type are currently lacking; studies are needed to better characterize these relationships.

Pleurotus sp. and *Pholiota* sp., which produce annual sporophores, commonly occur on trembling aspen, black cottonwood, and paper birch, but are not as common as heartrot fungi that form perennial sporophores on these tree species. *Phellinus igniarius* (L. ex Fr.) Quel. and *Fomes fomentarius* (Fr.) Kichx. account for the majority of decay in paper birch, with the former stem decay fungus being the most important in terms of both incidence and decay volume. *Phellinus tremulae* (Bord.) Bond & Boriss. accounts for the majority of stem decay in both trembling aspen and black cottonwood.

STATUS OF ANIMAL DAMAGE

PORCUPINE
Erethizon dorsatum

Porcupines cause severe damage to Sitka spruce and western hemlock in numerous local areas of southeast Alaska. An extensive survey has been completed that documents the level of porcupine damage in young-growth stands. Damage is confined to the known distribution of porcupine; thus, trees are not damaged where the porcupine is absent such as Prince of Wales, Kuiu, Baranof, Chichagof, and Admiralty Islands. Damage is especially serious on Mitkof Island in southeast Alaska. Other damage has been noted at Thomas Bay, Cleveland Peninsula, Bradfield Canal, Anita Bay, Douglas Island, and the Juneau area. Shore pine near Haines has been damaged the last few years. Feeding behavior of porcupines changes as forests age and trees become larger and older. Porcupines climb smaller trees and kill or cause topkill by removing bark along the entire bole, or the bole near the top of the tree. As trees become larger, around 40-50 years old, porcupines climb fewer trees and most of the damage is in the form of basal wounding. Most of these larger trees are not killed, but the large basal scars allow fungi to enter the bole and begin to cause wood decay.

Porcupines also damage trees throughout interior Alaska. Bark beetles, including *Ips* spp., have been found infesting damaged trees.

BROWN BEAR
Ursus arctos

Yellow-cedar trees were wounded by brown bears in spring on Baranof and Chichagof Islands. Brown bears rip the bark away from the lower boles of these trees, apparently to taste the sweet cambium. Other tree species are unaffected. Trees with old scars have associated columns of wood decay that will limit the value of their butt logs.

INTEGRATED PEST MANAGEMENT ACTIVITIES

Integrated pest management has been described as a "systems approach to alter pest damage to acceptable levels through a variety of techniques, including predators and parasites, genetically resistant hosts, natural environmental modifications, and when necessary and appropriate, chemical pesticides." Current FHM activities in Region 10 include:

(1) Participation in a cooperative effort with the Alaska Agricultural Research Station and the Cooperative Extension Service to provide pest management information to Alaska residents. The program, which includes education, research and survey activities, and provides integrated pest management information concerning urban forestry and garden and greenhouse pests. This program includes an IPM Newsletter that is published monthly throughout the summer. In 1992, there were nine pest scouts (7 full-time, 2 part-time) in seven communities in Alaska: Fairbanks, Delta Junction, Palmer, Anchorage, Soldotna, Juneau, and Kodiak. The 1992 IPM Pest Scouts had a very full summer season. The end of the season records indicate that there were over 2,100 telephone contacts, over 400 specimens diagnosed, and over 400 site visits made statewide.

(2) A ground application of methylcyclohexenone (MCH) for the prevention of spruce beetle attacks and population build-up in standing, uninfested spruce in a popular Kenai Peninsula campground was undertaken in the spring of 1992. MCH is the naturally occurring antiaggregating pheromone of the spruce beetle. That is, it functions as a repellent. The study was undertaken in a campground that had come under heavy attack by the spruce bark beetle the last three years. The objective of the study was to see if the application of MCH in a Bubble-cap formulation would significantly reduce the number of spruce beetle attacks on large diameter campground spruce. There was no significant protection afforded by the application of the MCH bubble caps. The spruce beetle dispersal flight and subsequent tree attacks were once again, extremely high; approximately 150 trees were successfully attacked in the "treated" campground. It appears that MCH is not an effective tool when populations are in epidemic conditions as the antiaggregant pheromone released from the bubble caps is "overwhelmed" by the large amounts of naturally occurring aggregant pheromone.

(3) Airborne video technology is currently being used to monitor spruce beetle outbreaks in southeast and south-central Alaska. This work is being done to enhance current spruce beetle detection and monitoring capabilities. This airborne video project is being completed in cooperation with the Chatham Area (Tongass National Forest), Glacier Bay National Park and the State of Alaska (Department of Natural Resources, Division of Forestry).

SUBMITTING INSECTS AND DISEASES FOR IDENTIFICATION

The following procedures for the collection and shipment of specimens should be used for submitting samples to specialists:

I. Specimen collection:
  1. Adequate material should be collected
  2. Adequate information should be noted, including the following:
  a. Location of collection
  b. When collected
  c. Who collected the specimen
  d. Host description (species, age, condition, # of affected plants)
  e. Description of area (e.g., old or young forest, bog, urban);
  f. Unusual conditions (e.g., frost, poor soil drainage, misapplication of fertilizers or pesticides?).
  3. Personal opinion of the cause of the problem is very helpful

II. Shipment of specimens:
  1. General: Pack specimens in such a manner to protect against breakage.
  2. Insects: If sent through the mail, pack so that they withstand rough treatment.
  a. Larvae and other soft-bodied insects should be shipped in small screw-top vials or bottles containing at least 70% isopropyl (rubbing) alcohol. Make certain the bottles are sealed well. Include in each vial adequate information, or a code, relating the sample to the written description and information. Labels inserted in the vial should be written on with pencil or India ink. Do not use a ballpoint pen, as the ink is not permanent.
  b. Pupae and hard-bodied insects may be shipped either in alcohol or in small boxes. Specimens should be placed between layers of tissue paper in the shipping boxes. Pack carefully and make certain that there is very little movement of material within the box. Do not pack insects in cotton.
  3. Needle or foliage diseases: Do not ship in plastic bags. Sprinkle lightly with water before wrapping in newspaper. Pack carefully and make sure that there is very little movement of material within the box. Include the above collection information. For spruce and other conifers, include a description of whether current year's-needles, last-year's needles, or old-needles are attacked.
  4. Mushrooms and conks (bracket fungi): Do not ship in plastic bags. Either pack and ship immediately, or first air dry and then pack. To pack, wrap specimens in dry newspaper and pack into a shipping box with more newspaper. If on wood, include some of the decayed wood. Be sure to include all collection information.

III. Shipping:
  1. Ship as quickly as possible, especially if specimens are fresh and not air-dried. If samples cannot be shipped rapidly, then store in a refrigerator.
  2. Include address inside shipping box.
  3. Mark on outside: "Fragile: Insect-disease specimens enclosed; For scientific purposes only; No commercial value."

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MAILING LIST UPDATE AND REVISION

At this time, we wish to update our mailing list of all cooperators. Only those persons or agencies returning this form by June 15, 1993 will receive subsequent mailings of reports. Please complete this form and return to:

Forest Health Management
USDA Forest Service
201 E. Ninth Ave., Suite 201
Anchorage, Alaska 99501

Your current address:

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I would like to receive the following publications:
(please check one or more)

- ☐ Insect biological evaluations
- ☐ Disease biological evaluations
- ☐ Insect technical reports
- ☐ Disease technical reports
- ☐ Annual Reports on insect and disease conditions in Alaska

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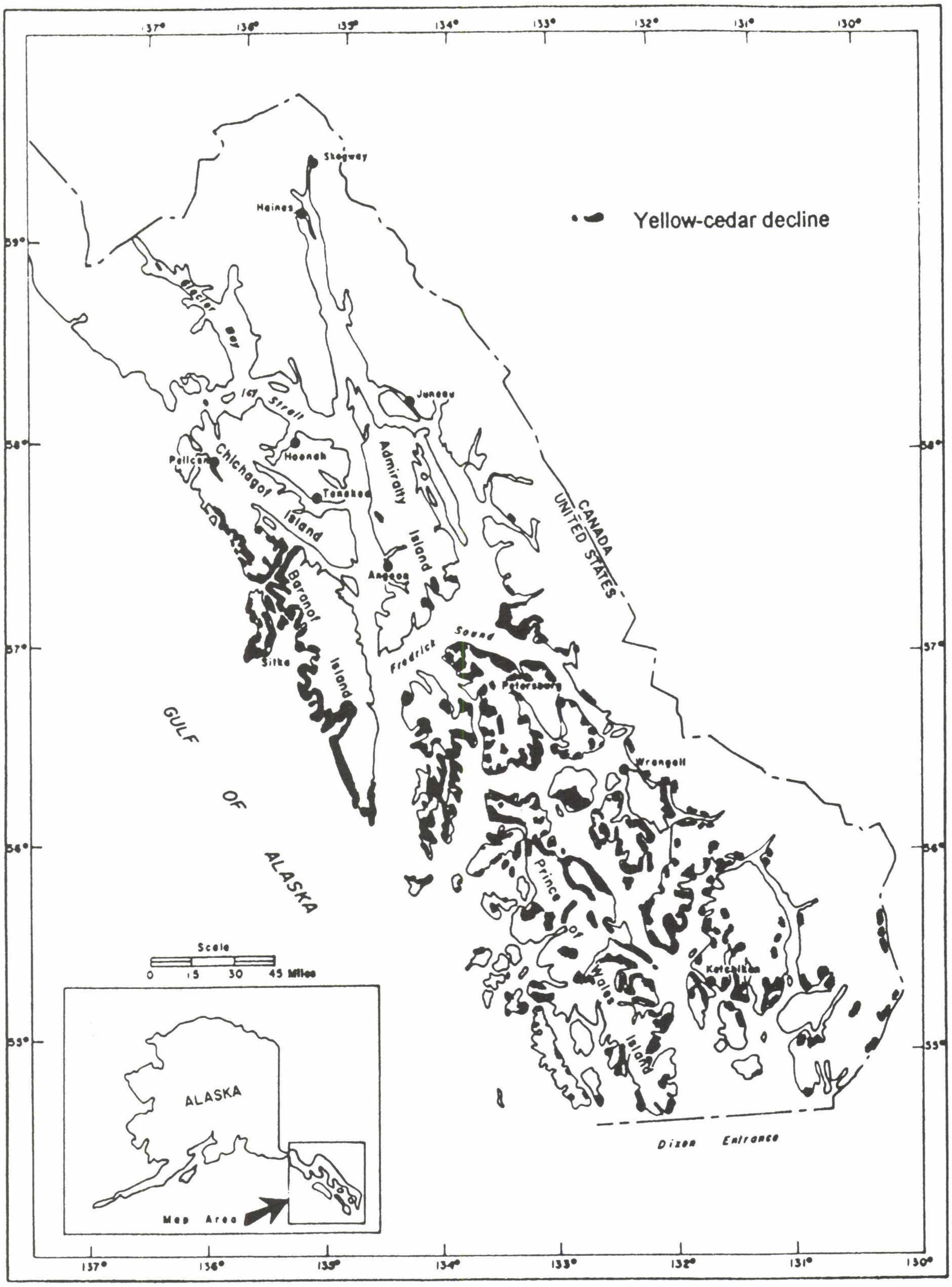
137°
136°
135°
134°
133°
132°
131°
130°
59°
58°
57°
56°
55°
Yellow-cedar decline
Skagway
Haines
Glacier Bay
Icy Strait
Juneau
Hoonah
Pelican
Chichagof Island
Tenakee
Admiralty Island
Angoon
Baranof Island
Sitka
Fredrick Sound
Petersburg
Wrangell
CANADA
UNITED STATES
GULF OF ALASKA
Prince of Wales Island
Ketchikan
Dixon Entrance
Scale
0 15 30 45 Miles
ALASKA
Map Area

Distribution of yellow-cedar decline in southeast Alaska

Appendix A

ACREAGE AFFECTED BY YELLOW-CEDAR IN SOUTHEAST ALASKA AS OF 1992

	Acres
NATIONAL FOREST LAND	541,349
Chatham Area	132,590
Juneau Ranger District	1,167
Hoonah Ranger District	2,179
Sitka Ranger District	
Chichagof I	36,897
Baronof I	58,564
Kruzof I	27,971
Total	123,432
Admiralty Island Nat'l Mon. Wilderness	5,812
Stikine Area	233,870
Petersburg Ranger District	
Kupreanof I	79,913
Kuiu I	66,653
Mitkof I	8,602
Woewodski I	2,258
Mainland	7,707
Total	165,133
Wrangell Ranger District	
Etolin I	26,077
Wrangell I	16,648
Zarembo I	9,496
Woronofski I	622
Mainland	15,894
Total	68,737
Ketchikan Area	174,889
Thorne Bay Ranger District	
Prince of Wales I	29,204
Kosciusko I	12,027
Heceta I	1,463
Total	42,694
Ketchikan Area (continued)	
Craig Ranger District	
Prince of Wales I	41,152
Dall I. and Long I	1,323
Total	42,475
Ketchikan Ranger District	
Revillagigedo I	24,208
Gravina I	6,780
Mainland	22,028
Total	53,016
Misty Fjords Nat'l Mon. Wilderness	
Revillagigedo I	13,623
Mainland	23,081
Total	36,704
NATIVE LAND	17,667
Prince of Wales I	10,196
Kupreanof I	312
Sukkwan I	156
Ketchikan area	5,058
Annette I	1,945
STATE AND PRIVATE LAND	10,430
Sitka area	1,246
Mitkof I	1,362
Kupreanof I	234
Prince of Wales I	943
Wrangell area	311
Pelican area	156
Ketchikan area	2,131
Gravina I	2,958
Koscusko I	1089
TOTAL LAND AFFECTED	**569,446**

Appendix B

DECAY FUNGI ASSOCIATED WITH SPRUCE AND HEMLOCK IN ALASKA.

Species and authority	Hosts[a]	Type of decay[b]	Mode of attack[c]
Antrodia albobrunnea (Rommell) Ryvarden	WS	BC	S-HR
Antrodia carbonica (Overh.) Ryv. & Gilbn.	SS, WH	BC	S-HR
Antrodia crassa (Karst.) Ryvarden	WS	BR	S-HR,SR
Antrodia heteromorpha (Fr.) Donk	WS	BC	S-HR,SR
Antrodia serialis (Fr.) Donk	WS, SS	BC	S-HR
Antrodia xantha (Fr.) Ryv.	WS	BC	S-HR,SR
Armillaria ostoyae (Romagn.) Herink	WS, SS, WH, MH?	YS	P,S-R&B
Bjerkandera adusta (Willd.:Fr.) Karst.	WS	WR	P-SR
Botryobasidium vagum (Berk. & Curt.) Rogers	WS	WR	?
Ceriporiopsis rivulosa (Berk. & Curt.) Gilbn. & Ryv.	WS, SS, WH	WSR	P-HR
Chondrostereum purpureum (Fr.) Pouz.	WS	WR	S-SR
Climacocystis borealis (Fr.) Kotl. & Pouz.	SS	WMR	P-HR
Coniophora puteana (Schum. ex Fr.) Karst.	WS, WH	BC	P,S-R&B,HR,SR
Crustoderma dryinum (Berk. & Curt. in Berk.) Parm.	WS	WR	P-SR?
Dichomitus squalens (Karst.) Reid	WS	WPR	P-HR
Diplomitoporus crustulinus (Bres.) Dom.	WS	WR	S-SR
Diplomitoporus lindbladii (Berk.) Gilbn. & Ryv.	WS	WR	S-HR,SR
Echinodontium tinctorium (Ell. & Ev.) Ell. & Ev.	MH, WH?	YS	HR
Fomitopsis officinalis (Vill.:Fr.) Bond. & Sing.	WS, SS, WH	BC	P,S-HR,SR
Fomitopsis pinicola (Swartz.:Fr.) Karst.	WS, SS, WH, MH	BC	P,S-HR,SR
Fomitopsis cajanderi	WS, WH	BC	P,S-HR
Ganoderma applanatum (Pers.:Wallr.) Pat.	WS, SS, WH	WSR	S-HR,SR
Ganoderma oregonense Murr.	SS, WH	WSR	S-HR,SR
Gloeophyllum odoratum (Wulf.:Fr.) Imazeki	WS	BR	S-HR,SR
Gloeophyllum saepiarium (Wulf.:Fr.) Karst.	WS	BR	S-HR,SR
Hericium abietis (Weir in Hubert) Harrington	SS, WH, MH	WPR	P-HR,SR
Heterobasidion annosum (Fr.) Bref.	SS, WH	WPR	P-R&B,HR
Inonotus tomentosus (Fr.) Gilb.	WS, SS, MH	WPR	P-R&B
Laetiporus sulphureus (Bull.:Fr.) Bond. & Sing.	WS, SS, WH	BC	P,S-R&B
Laurilia sulcata (Burt) Pouz.	WS	WR	P-R&B
Lentinus kauffmanii Smith	SS	BPR	P-R&B
Perenniporia subacida (Peck) Donk	WS	WSR	P-R&B
Phaeolus schweinitzii (Fr.) Pat.	WS, SS, WH	BC	P-R&B
Phanerochaete gigantea (Fr.:Fr.) Rattan	WS	WR	P-SR

See footnotes at end of table.

Decay fungi associated with spruce and hemlock in Alaska (continued).

Species and authority	Hosts[a]	Type of decay[b]	Mode of attack[c]
Phanerochaete laevis (Pers.:Fr.) Fr.	WS	WR	S-HR?
Phellinus pini (Thore ex Fr.) Pil.	WS, SS, WH, MH	WPR	P-HR
Phellinus punctatus (Fr.) Pilat	WH	WR	S-HR,SR
Phellinus robustus (Karst.) Bourd. & Galz.	WH, MH	WR	P-HR,SR
Phellinus viticola (Schw.:Fr.) Donk	WS	WR	S-HR,SR
Pholiota alnicola (Fr.) Sing.	WS	YS	P-R&B
Pholiota aurivella (Bat. ex Fr.) Kumm.	WS, SS, WH	BMR	P-HR
Postia (Oligoporia) balsamea (Peck) Julich	WS, SS, WH	BC	P-R&B,SR
Postia (Oligoporia) guttulata (Peck) Julich	WS	BC	P-R&B
Postia (Oligoporia) placenta (Fr.) M.J. Larsen & Lombard	SS, WH	BC	S-HR,SR
Postia (Oligoporia) sericeomollis (Rommell) Julich	WS, SS, WH	BC	P,S-HR
Pycnoporellus alboluteus (Ell. & Ev.) Kotl. & Pouz.	WS	BC	S-SR
Scytinostroma galactina (Fr.) Donk	WS, WH	YS	P-R&B
Stereum sanguinolentum (Alb. & Schw.:Fr.) Fr.	WS, SS, WH, MH	YS	P,S-HR,SR
Trametes versicolor Fr.	SS, WH	WSR	S-SR
Trichaptum abietinus (Dicks.:Fr.) Ryvarden	WS, SS, WH	WPR	S-SR
Veluticeps abietina (Pers.:Fr.) Hjort. & Telleria	SS, WH	BC	S-HR

[a] Host species are: SS, Sitka spruce; WS, white spruce; MH, mountain hemlock; WH, western hemlock.

[b] Types of decay are: WR, white rot; YS, yellow stringy or yellow spongy rot; WMR, white mottled rot; WSR, white stringy or white spongy rot; WPR, white pocket rot; BR, brown rot; BC, brown cubical rot; BPR, brown pocket rot; BMR, brown mottled rot.

[b] Mode of attack is defined in a two-part code given as A-B. Before the hyphen, P and S are used to indicate primary and secondary attack, respectively. Primary attack means the decay typically occurs in living trees. After the hyphen, the codes R&B, HR, and SR are used to refer to root & butt rot, heart rot, and sap rot, respectively.